

FIG. 1
(PRIOR ART)

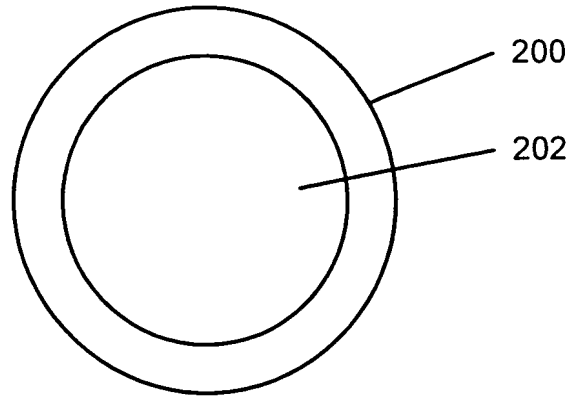


FIG. 2

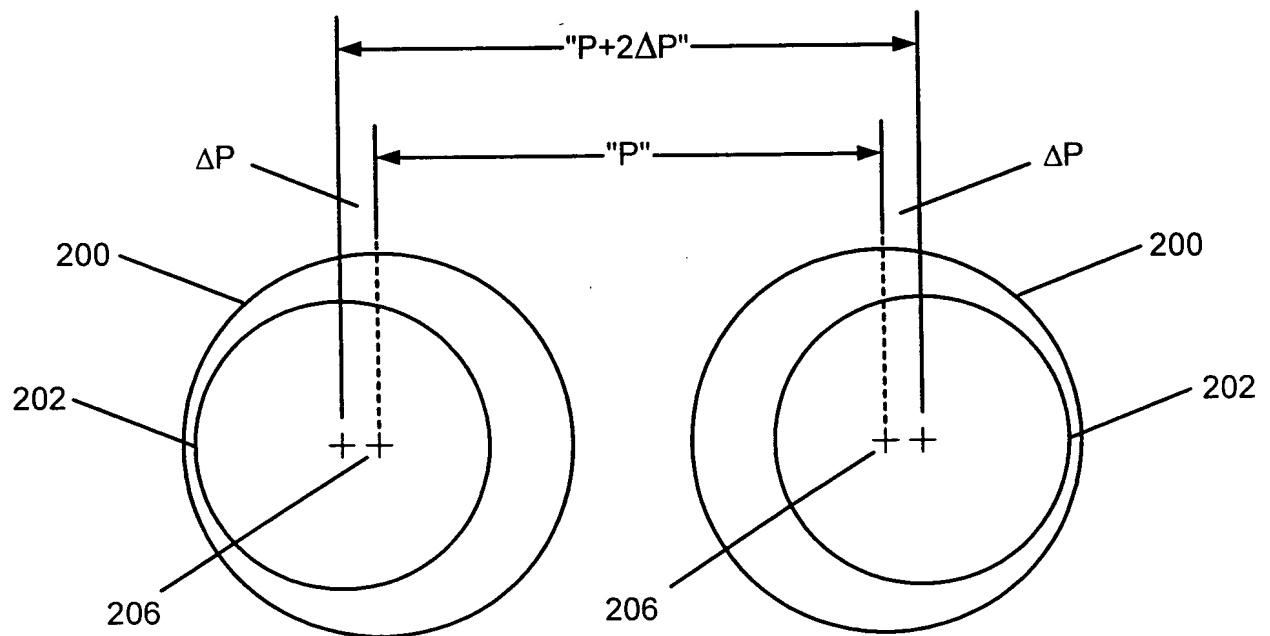


FIG. 3

FIG. 4A

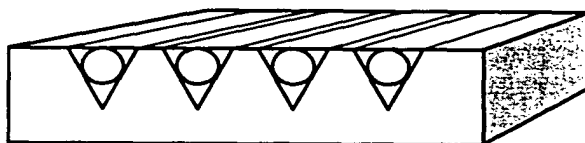


FIG. 4B

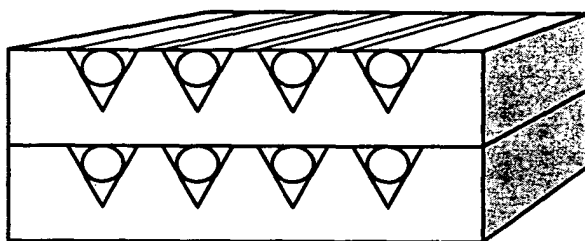
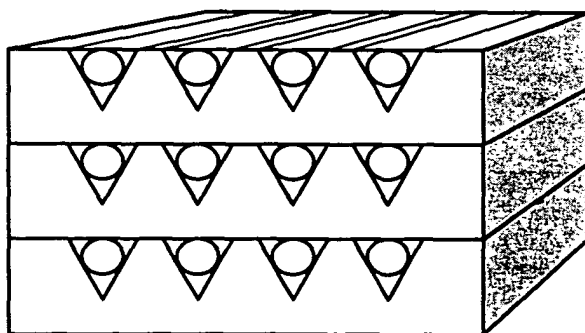


FIG. 4C



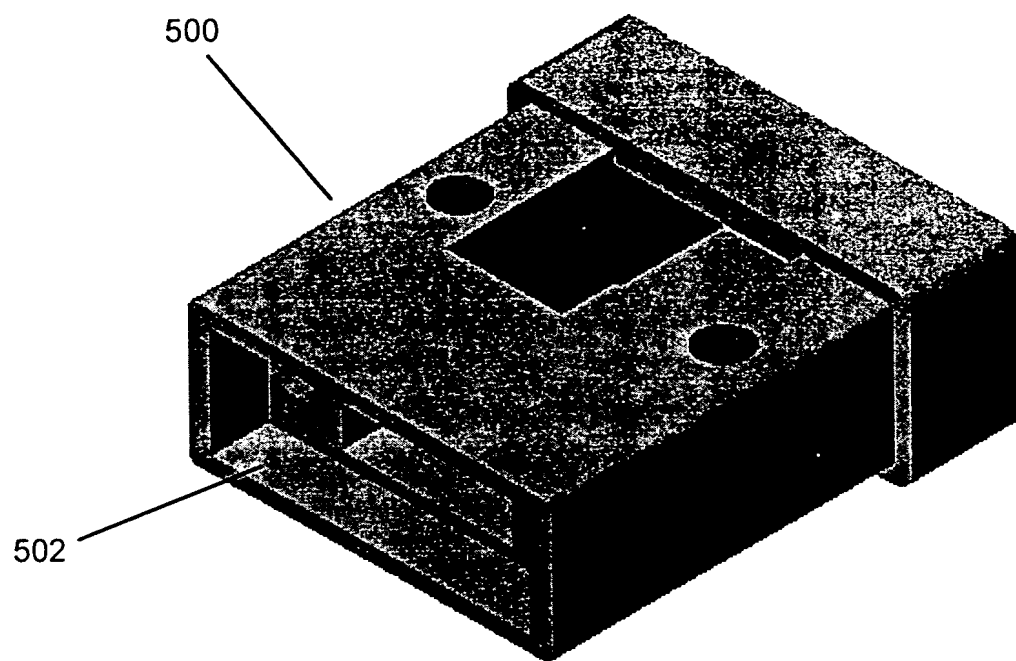


FIG. 5

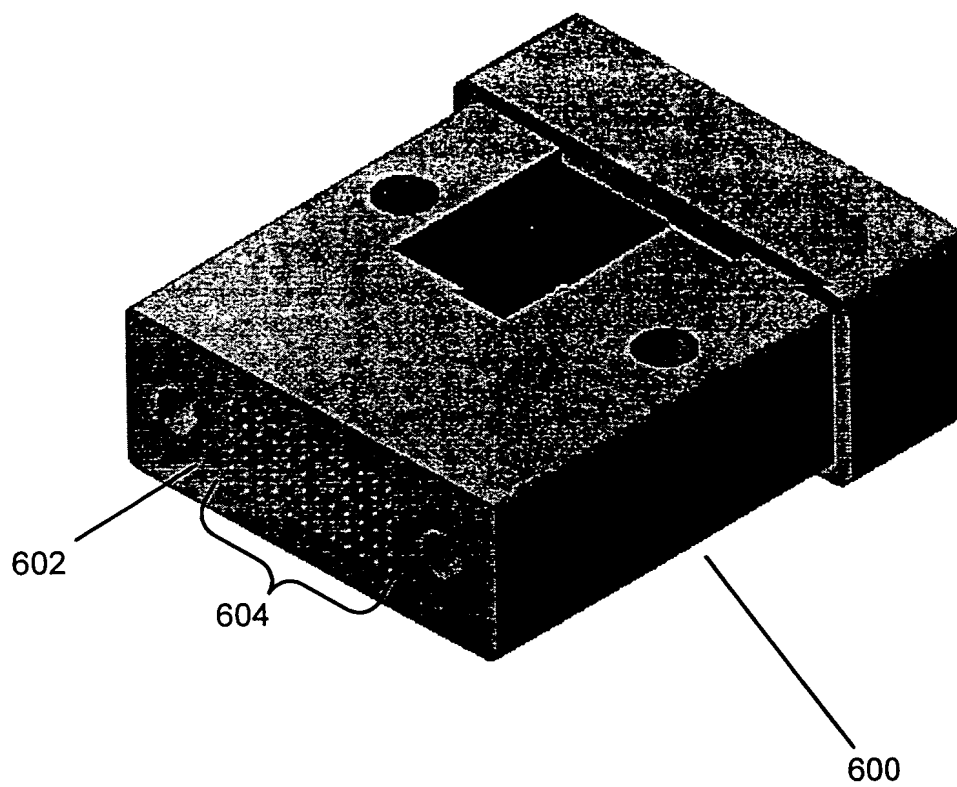


FIG. 6

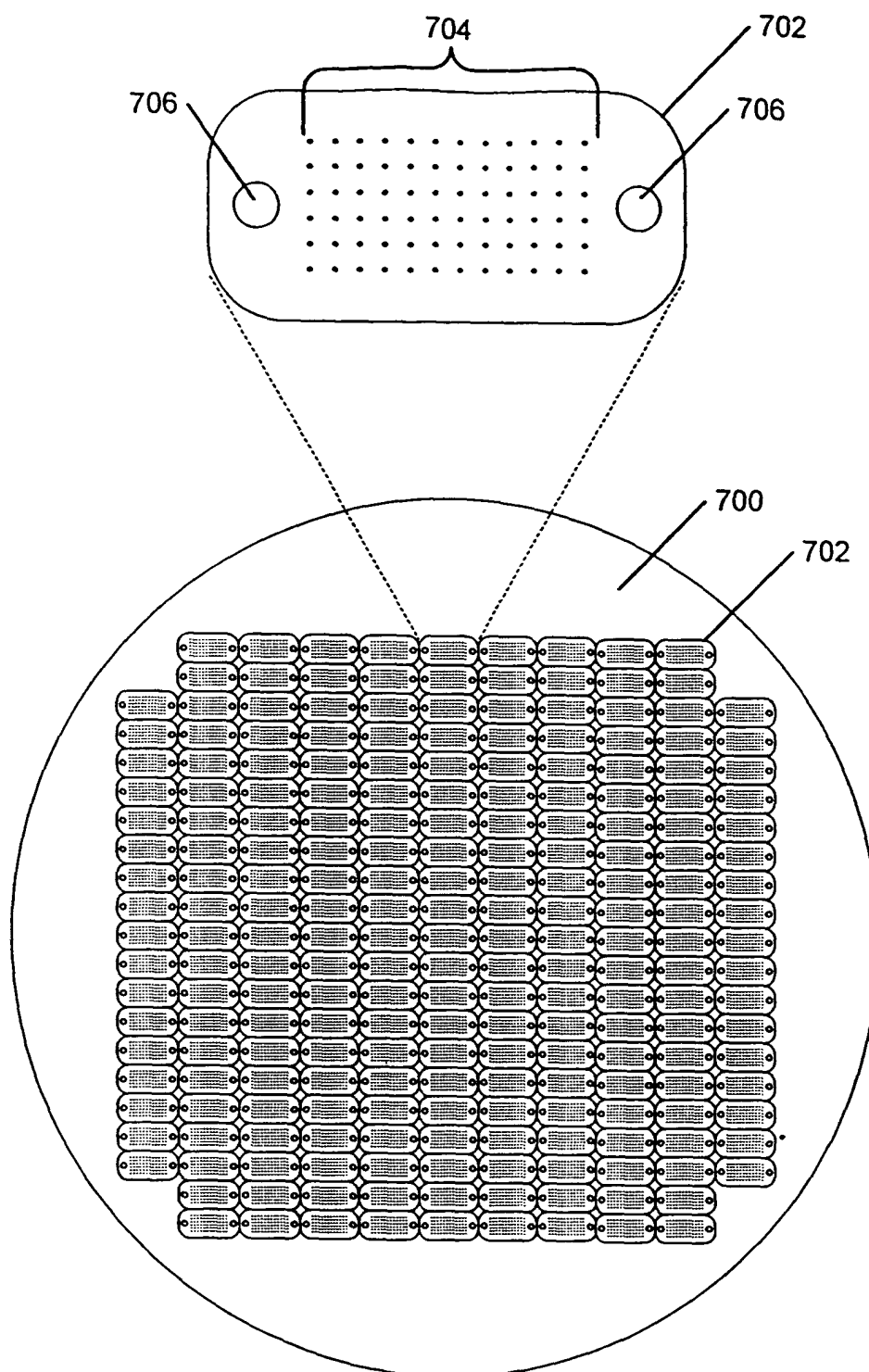


FIG. 7

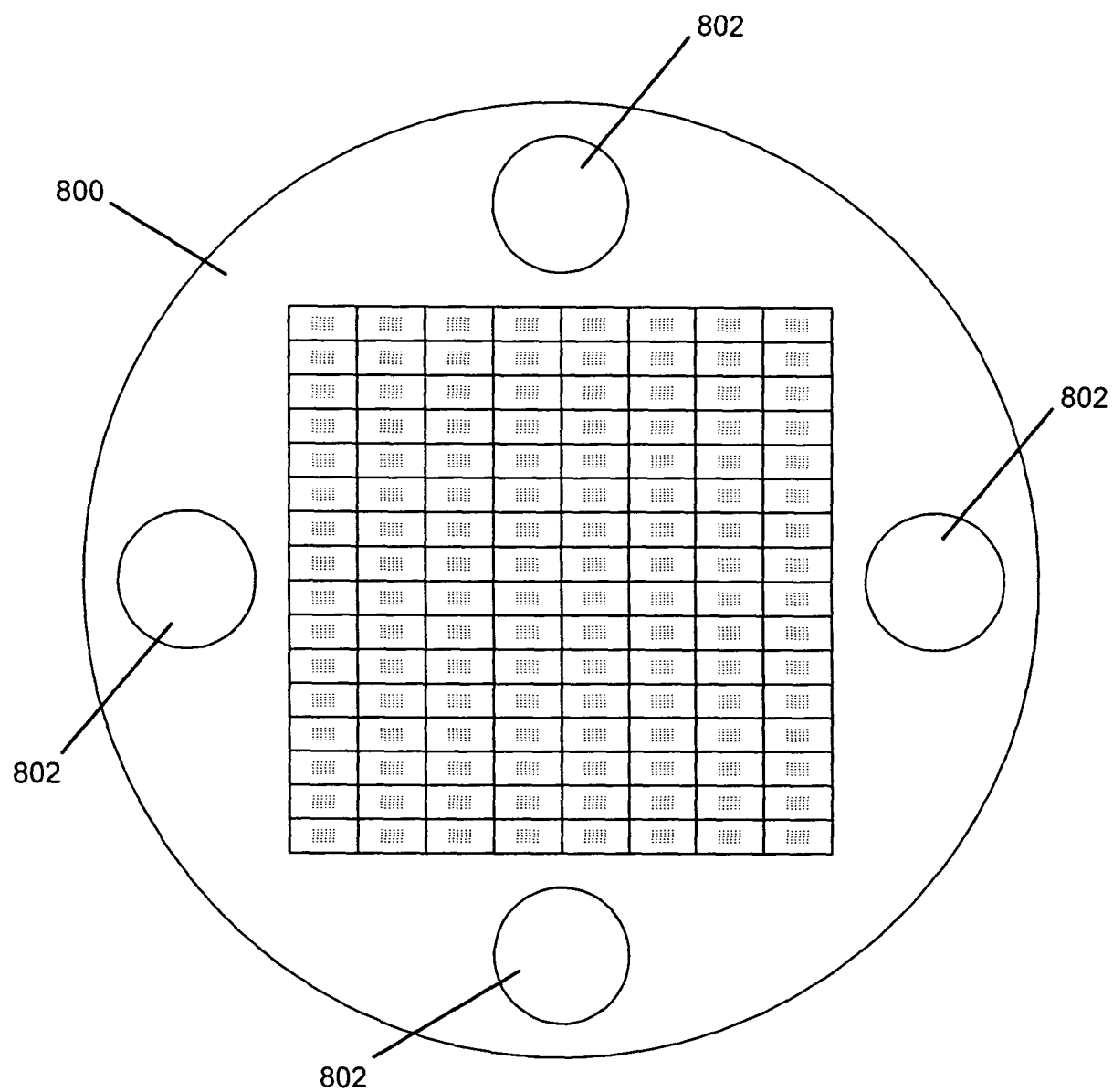


FIG. 8

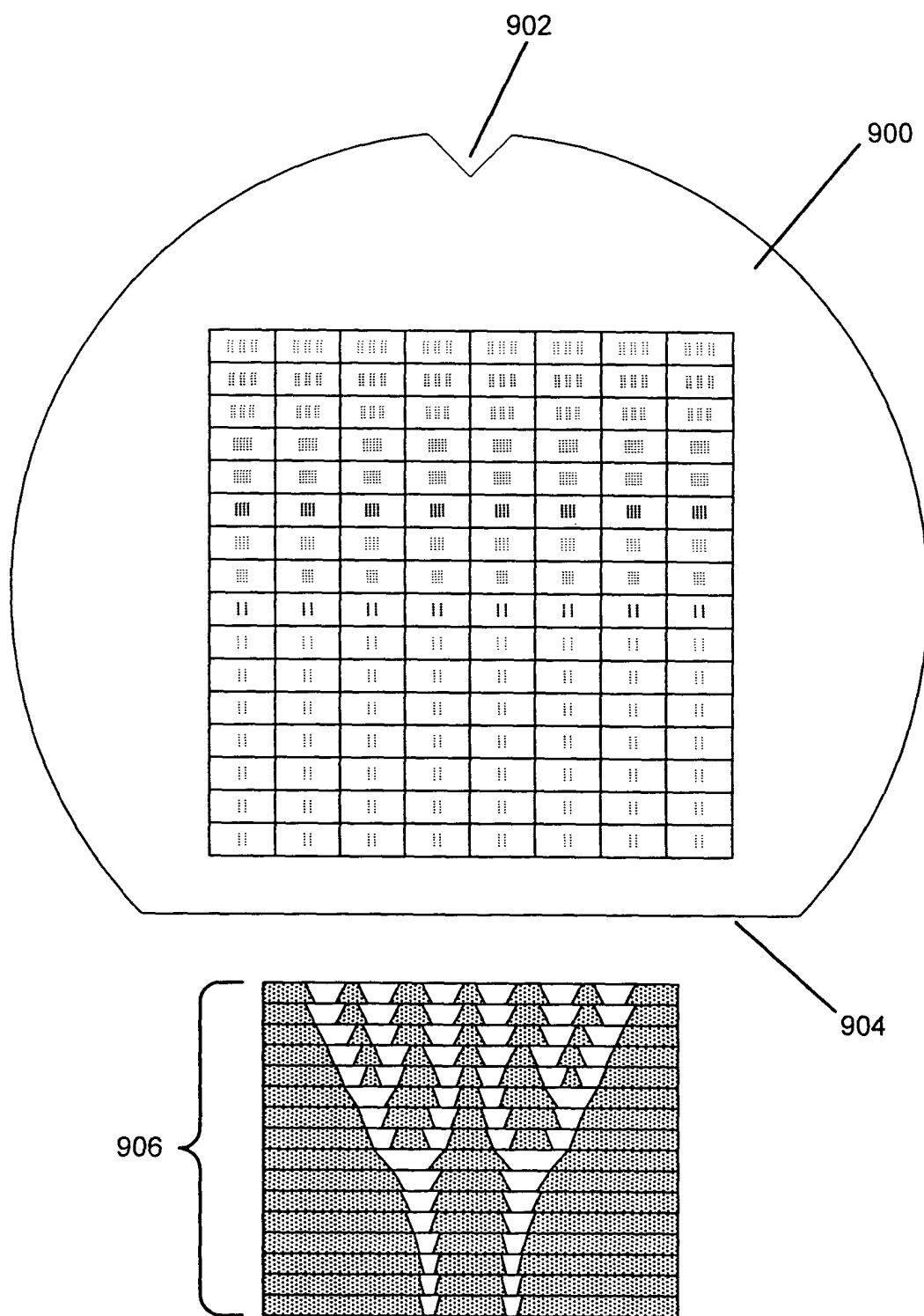


FIG. 9

FIG. 10A

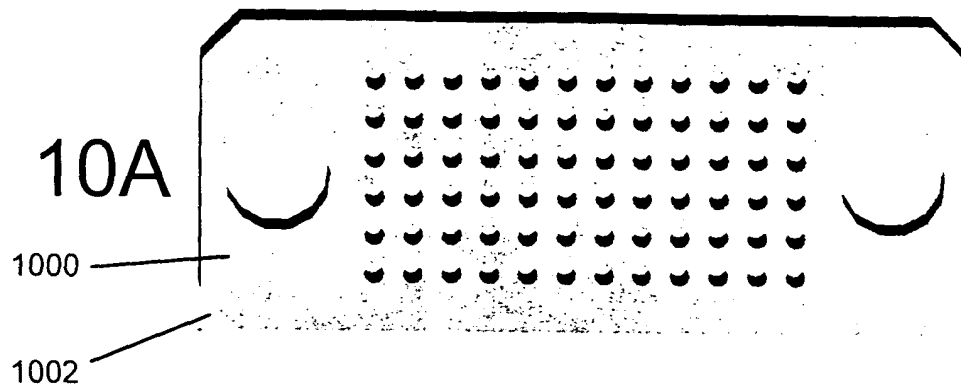


FIG. 10B

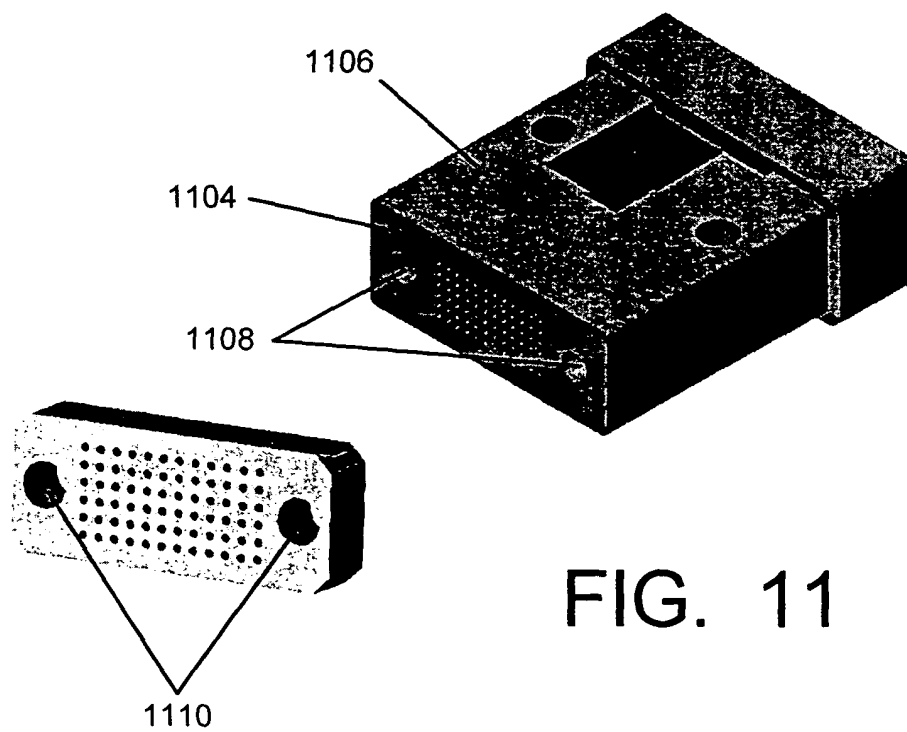
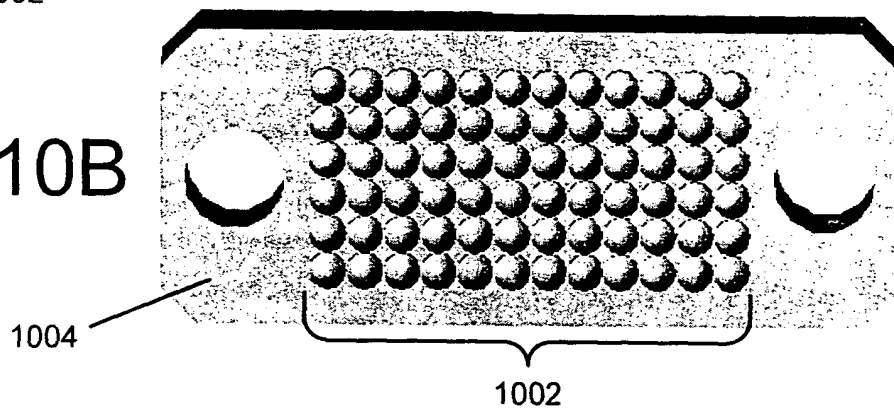


FIG. 11

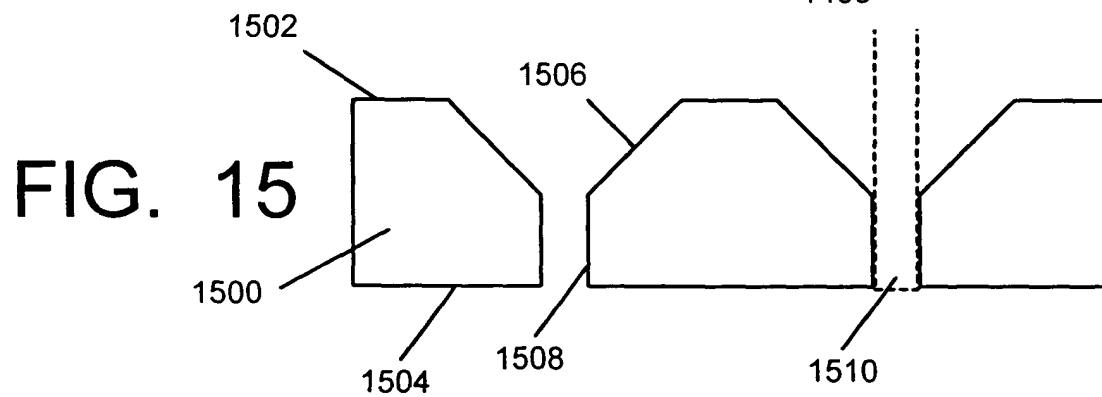
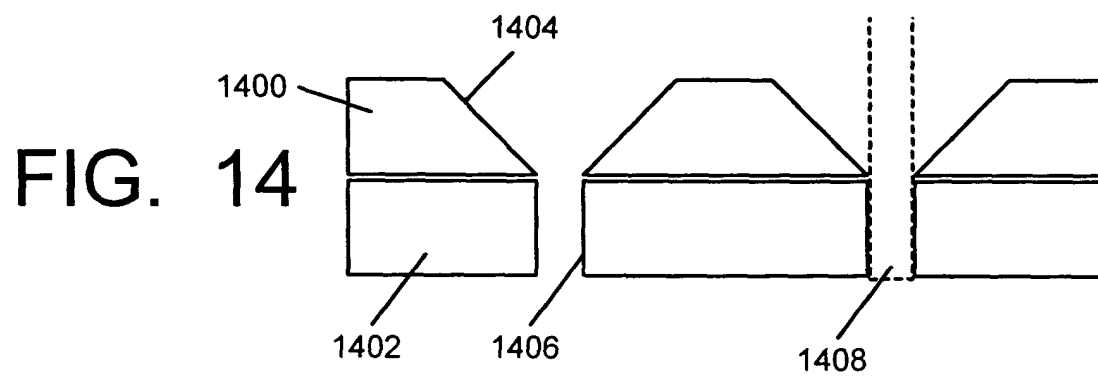
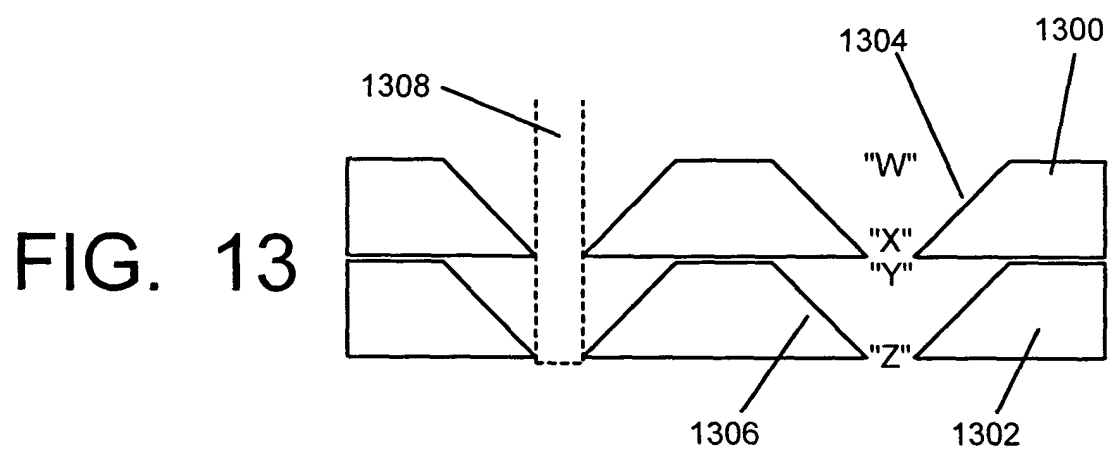
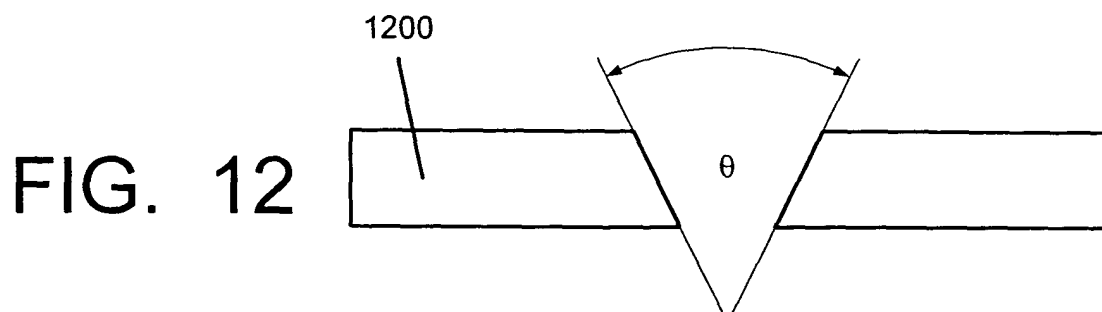


FIG. 16

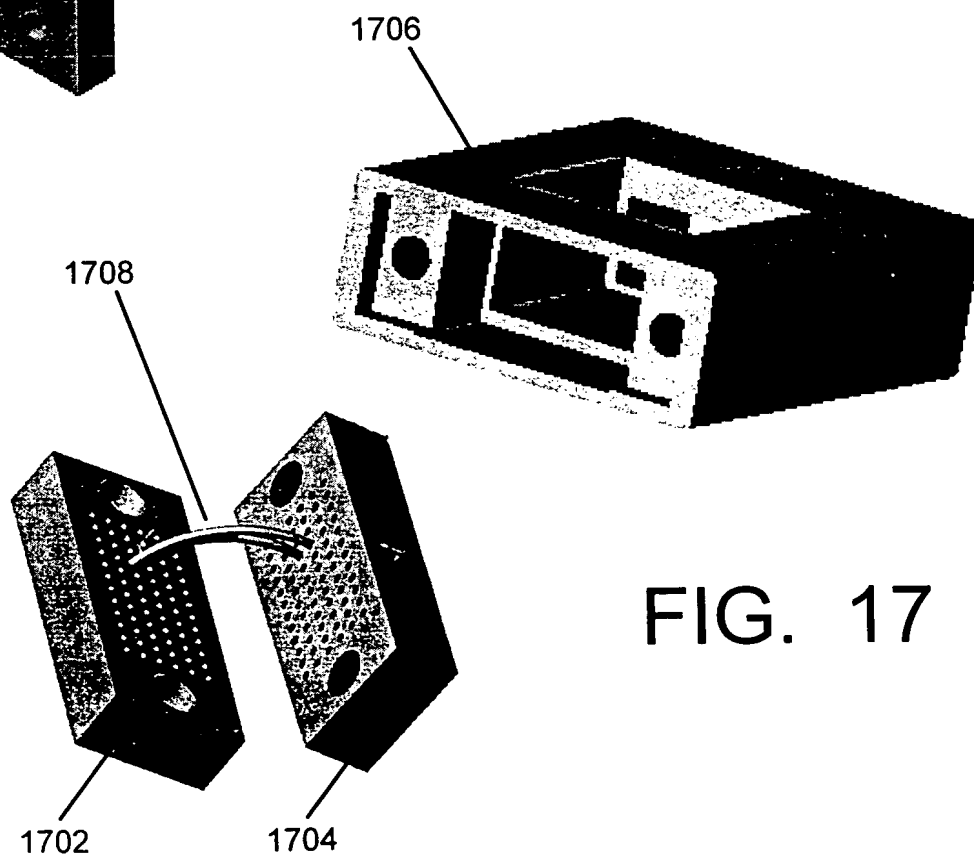
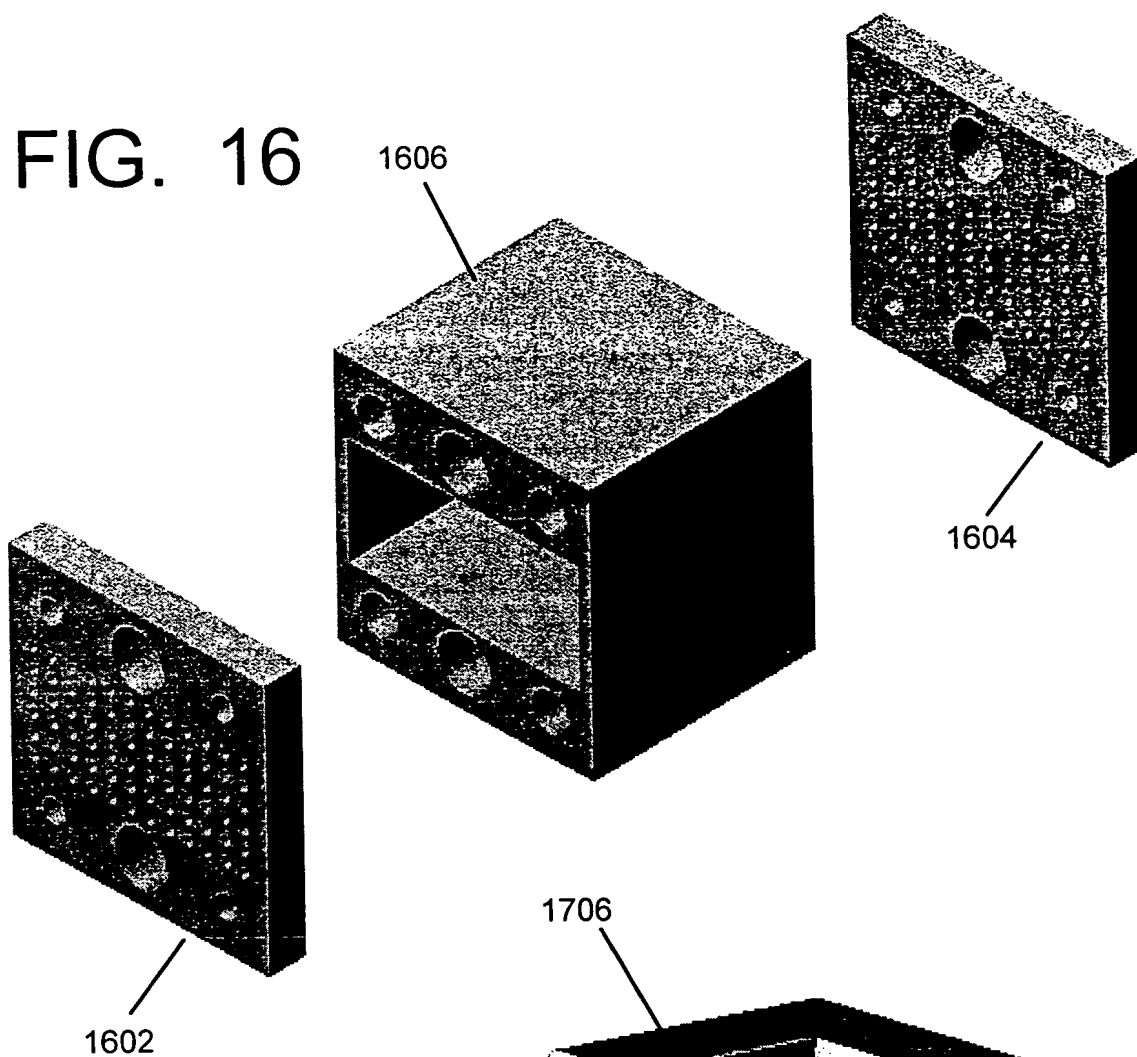


FIG. 17

FIG. 18

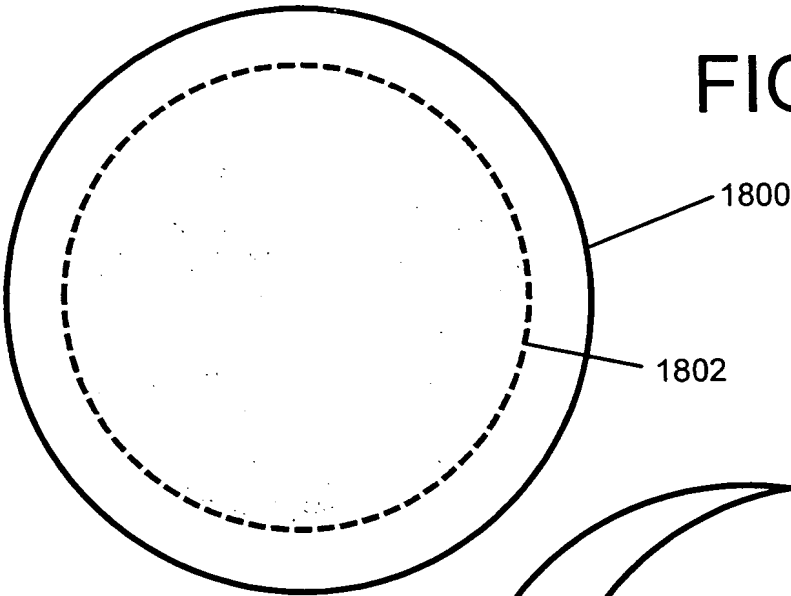


FIG. 19

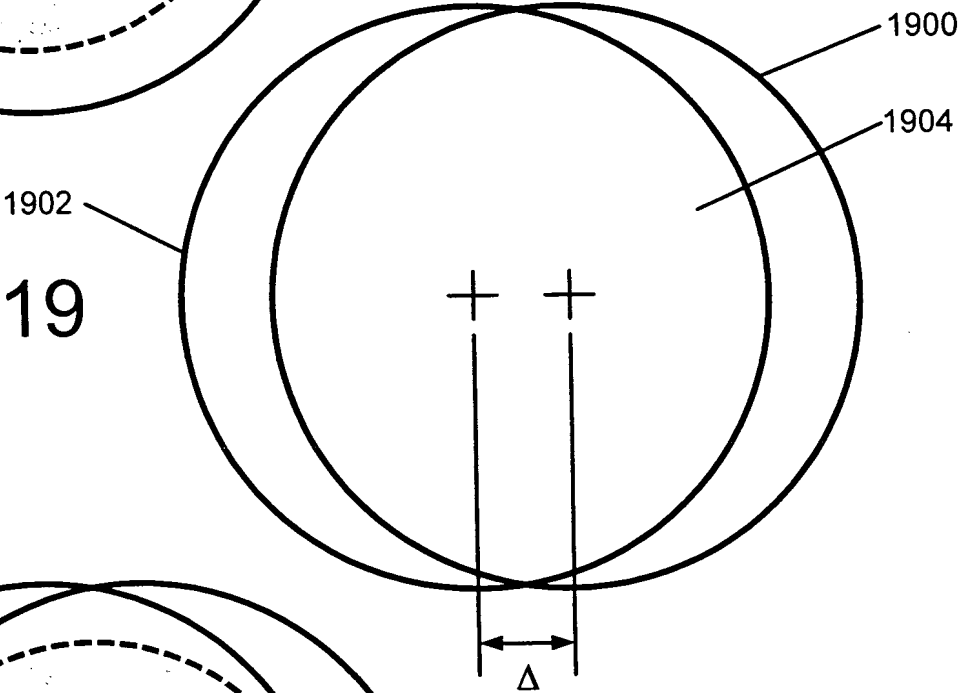
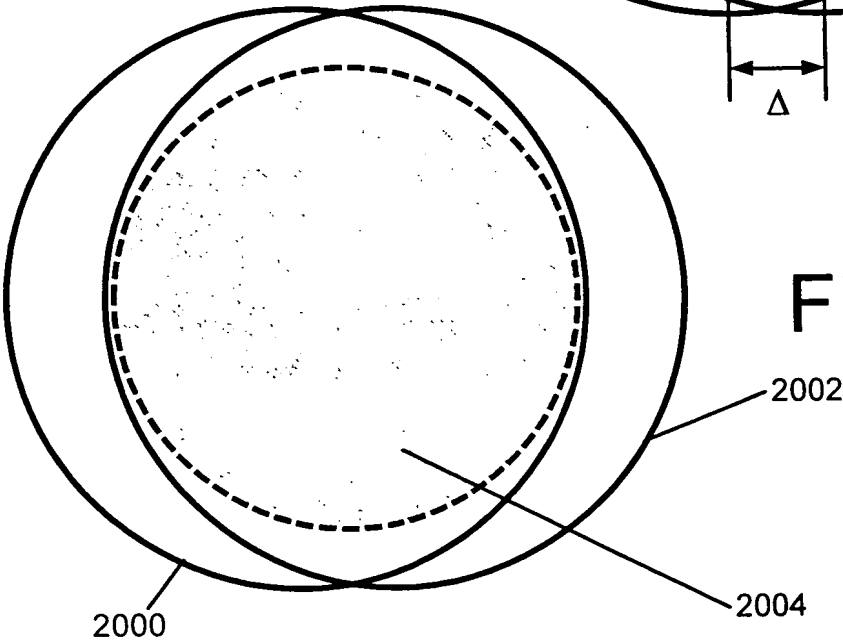


FIG. 20



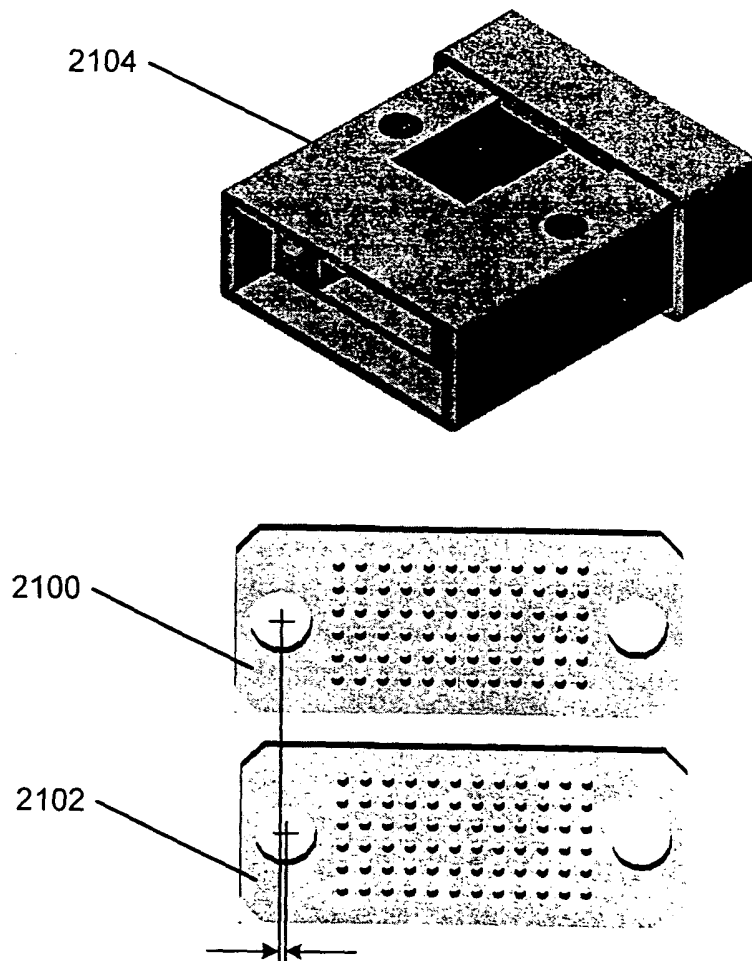
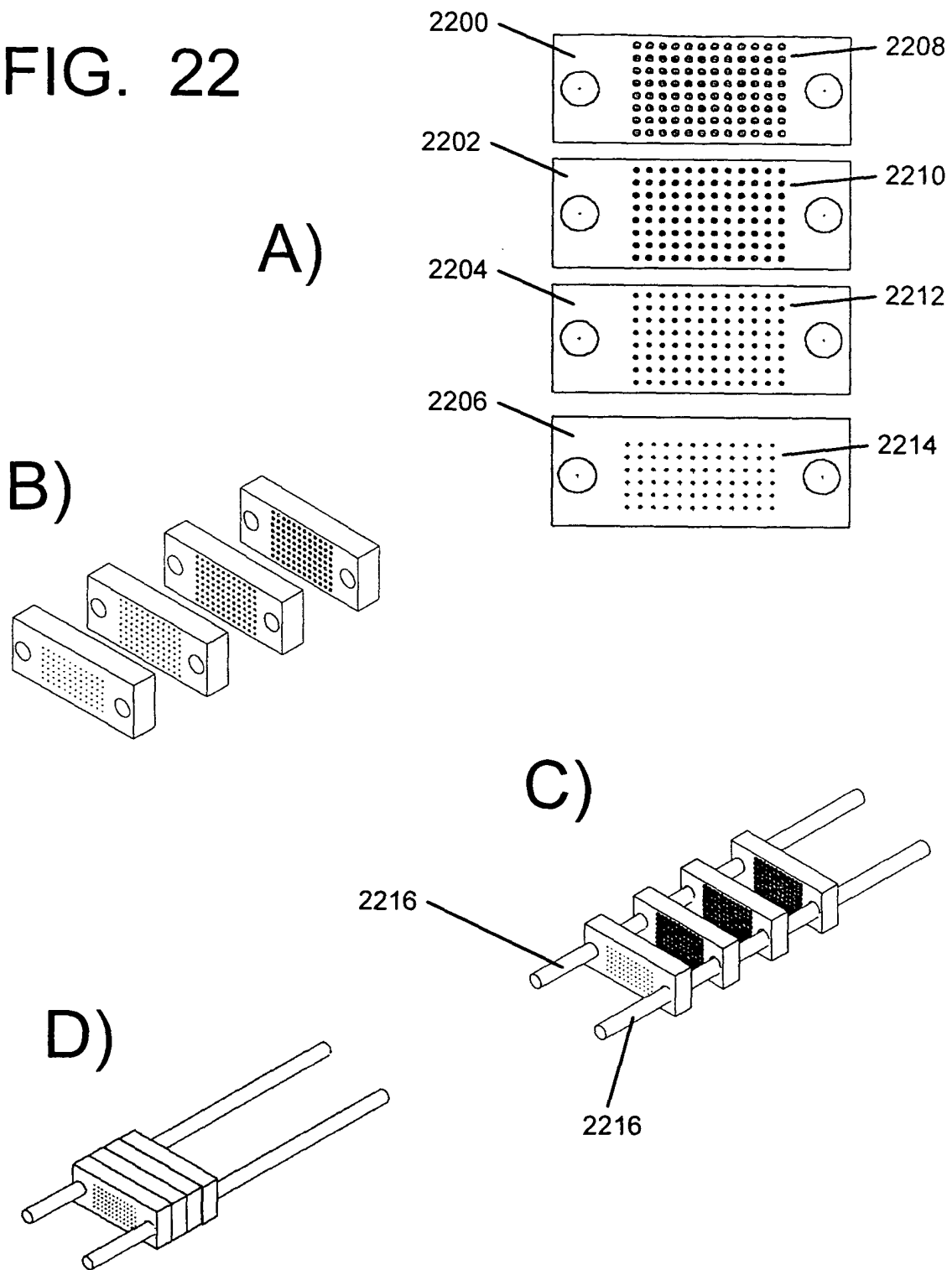


FIG. 21

FIG. 22



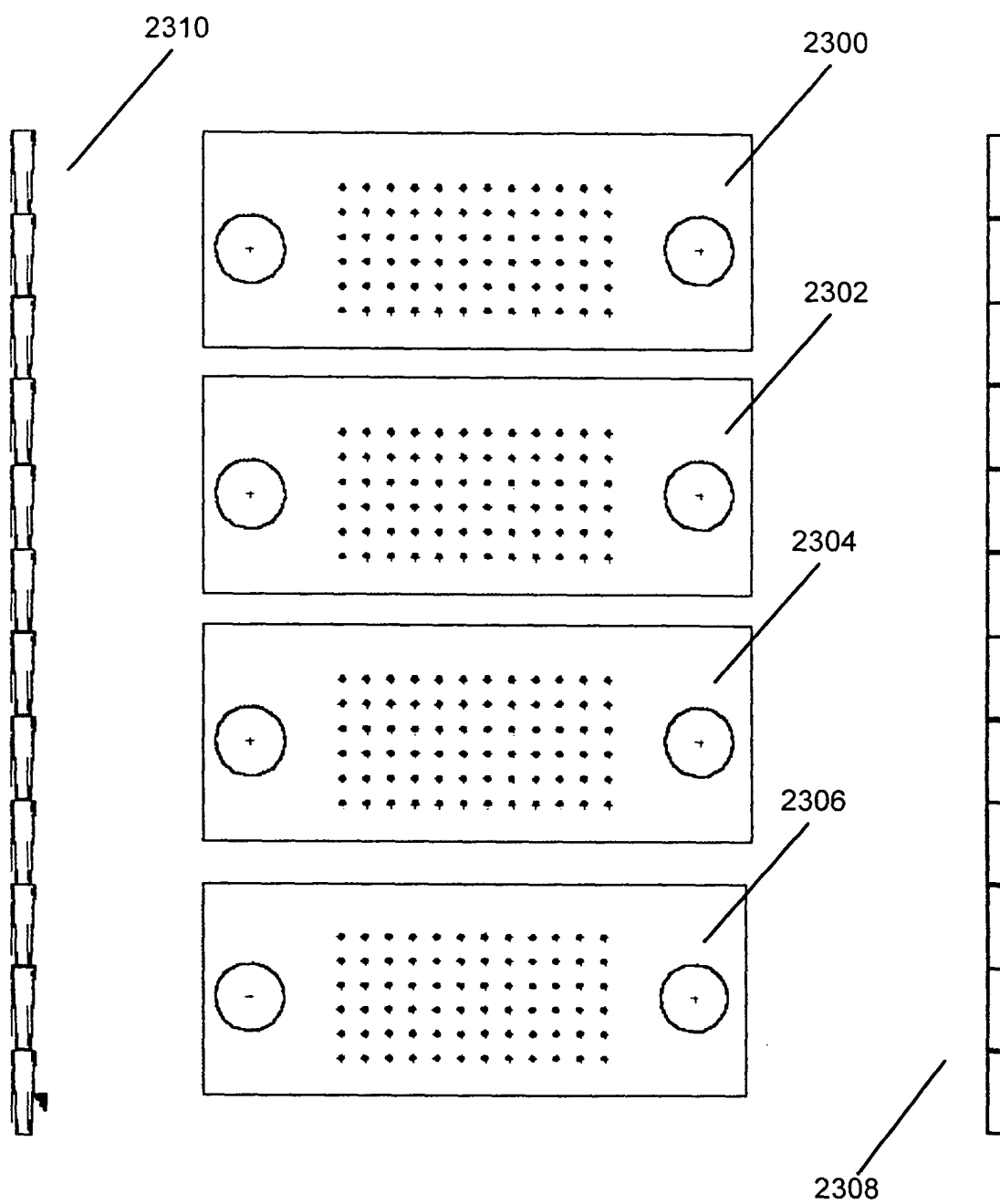
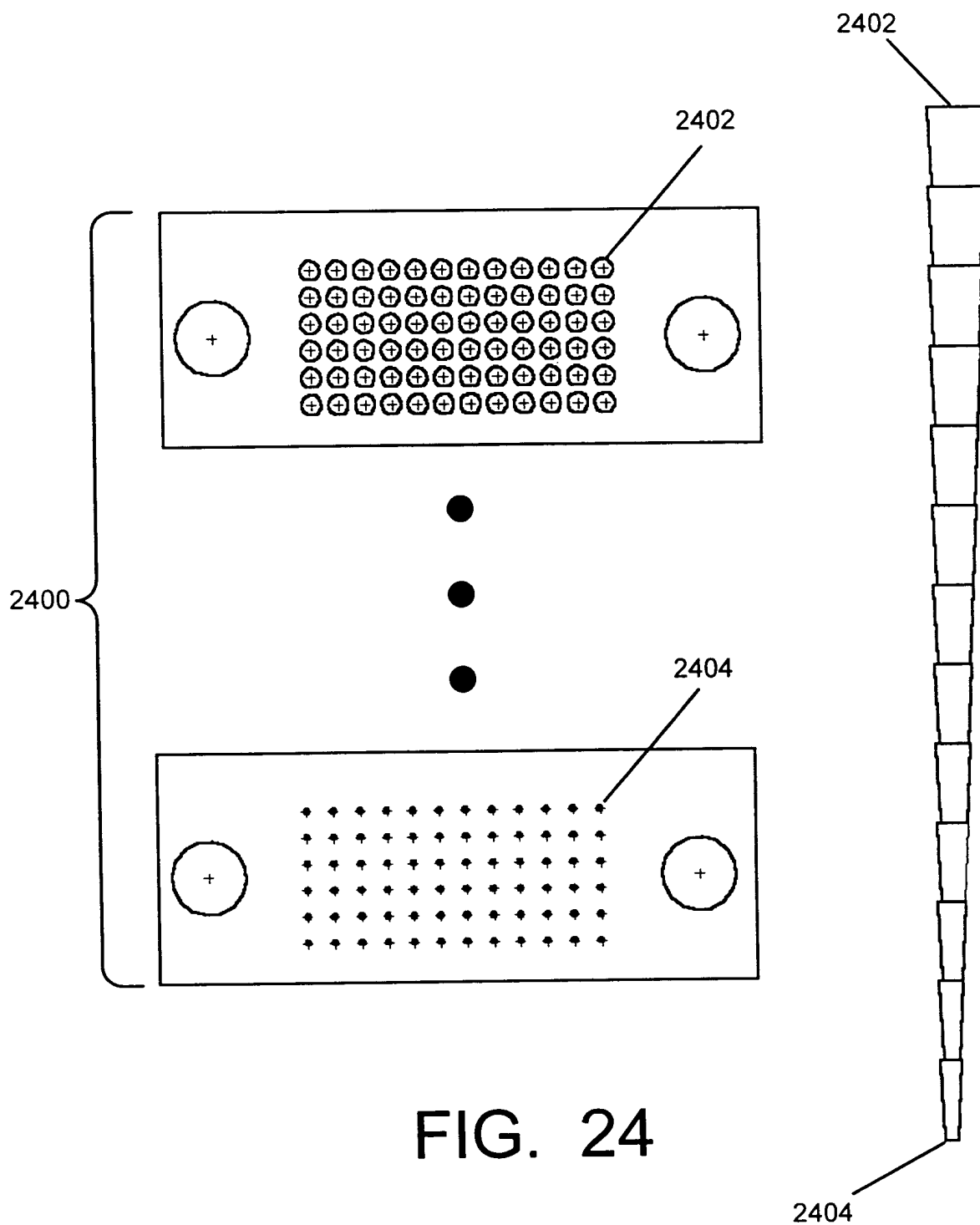


FIG. 23



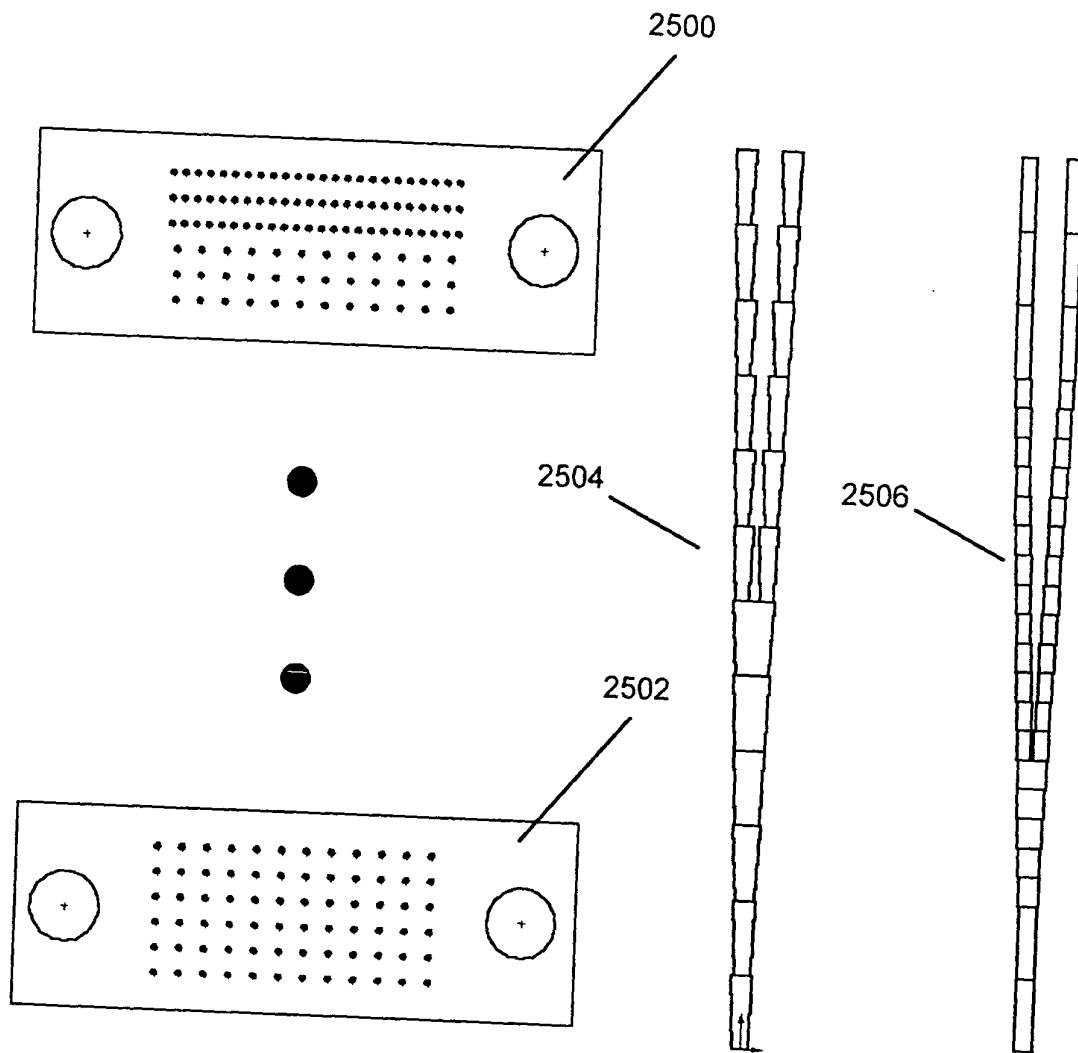
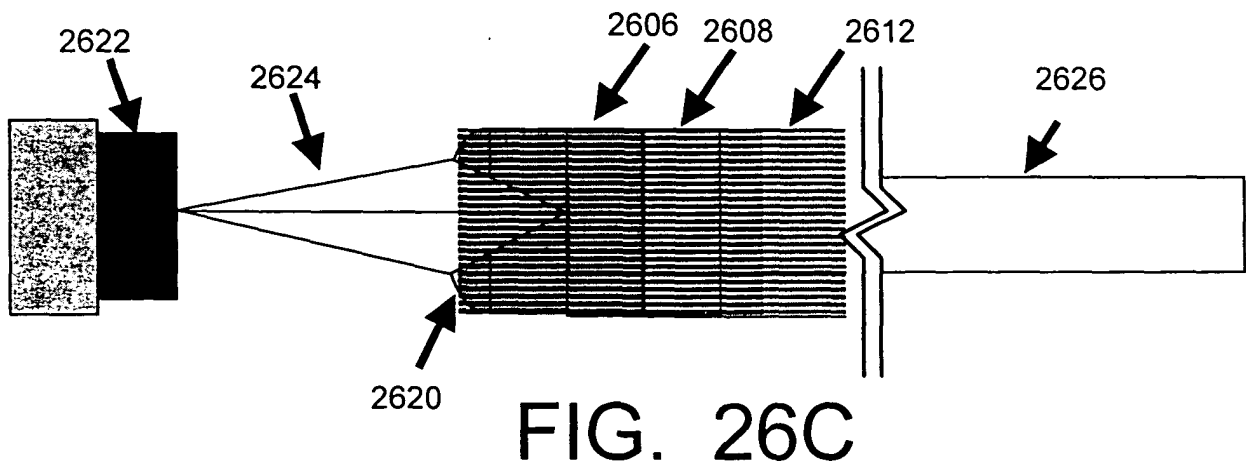
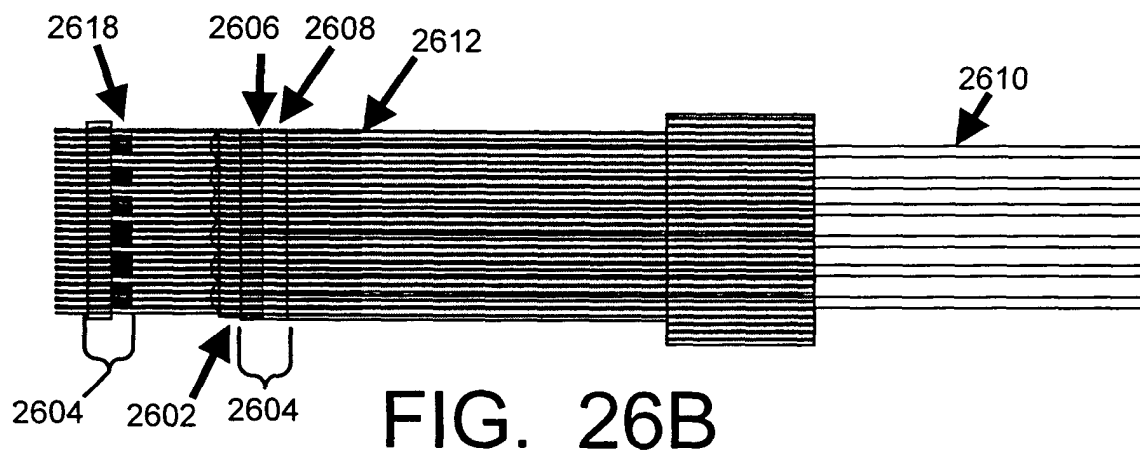
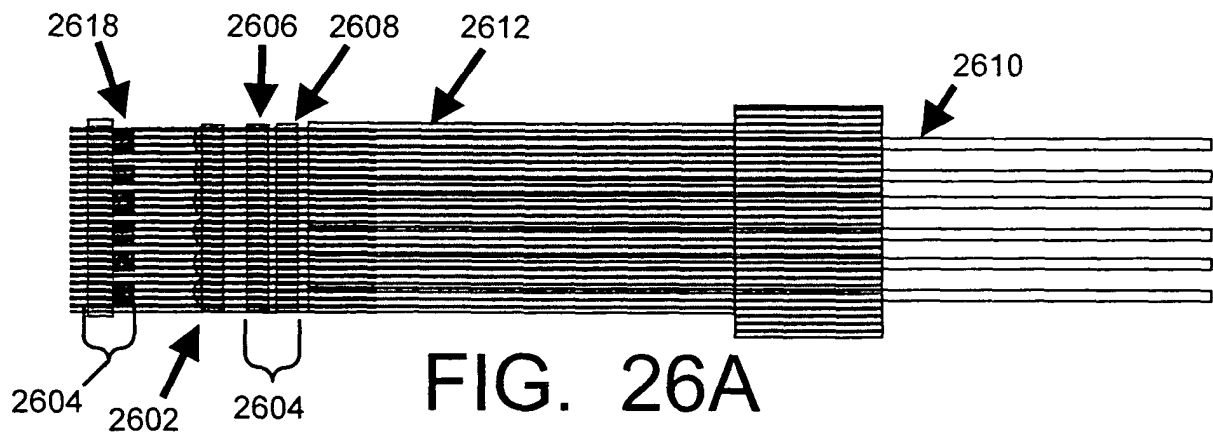


FIG. 25



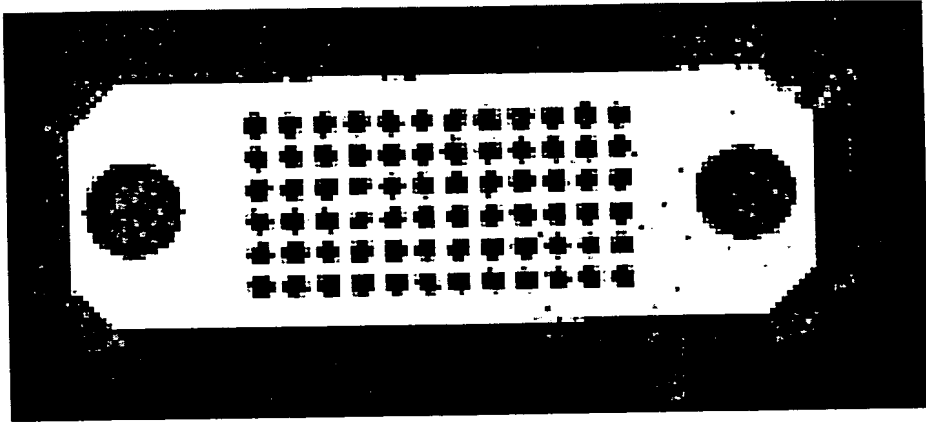


FIG. 27

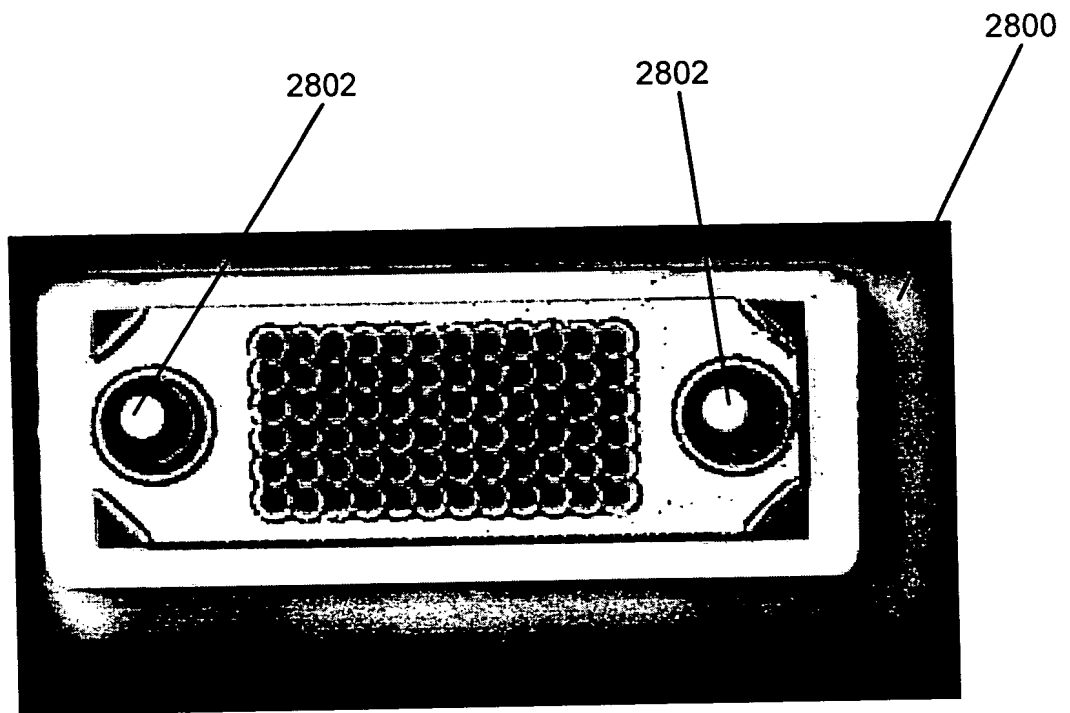


FIG. 28

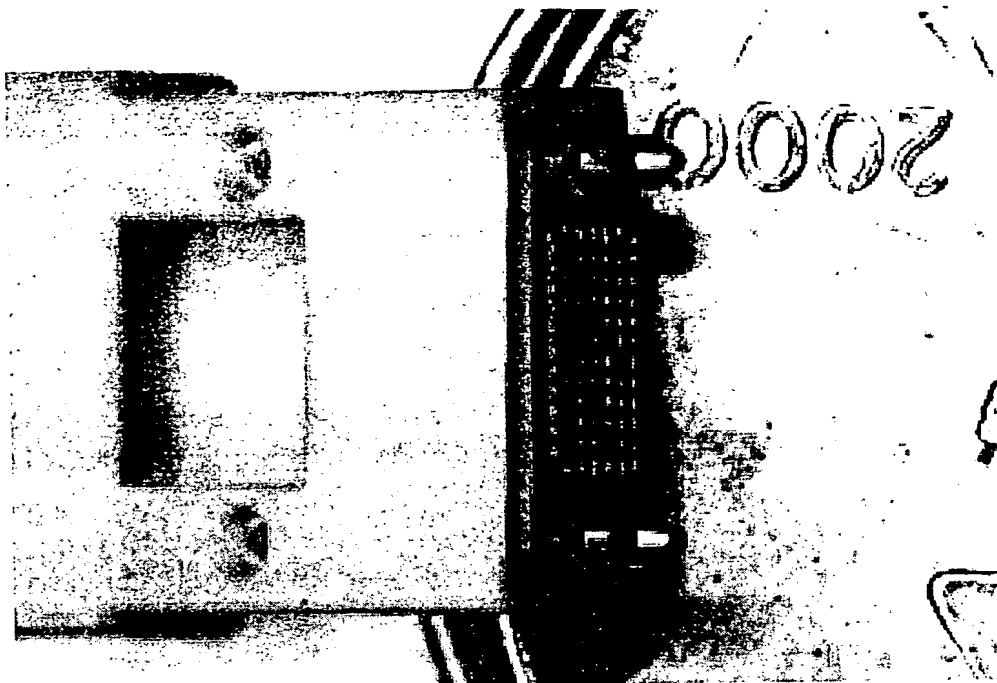


FIG. 29

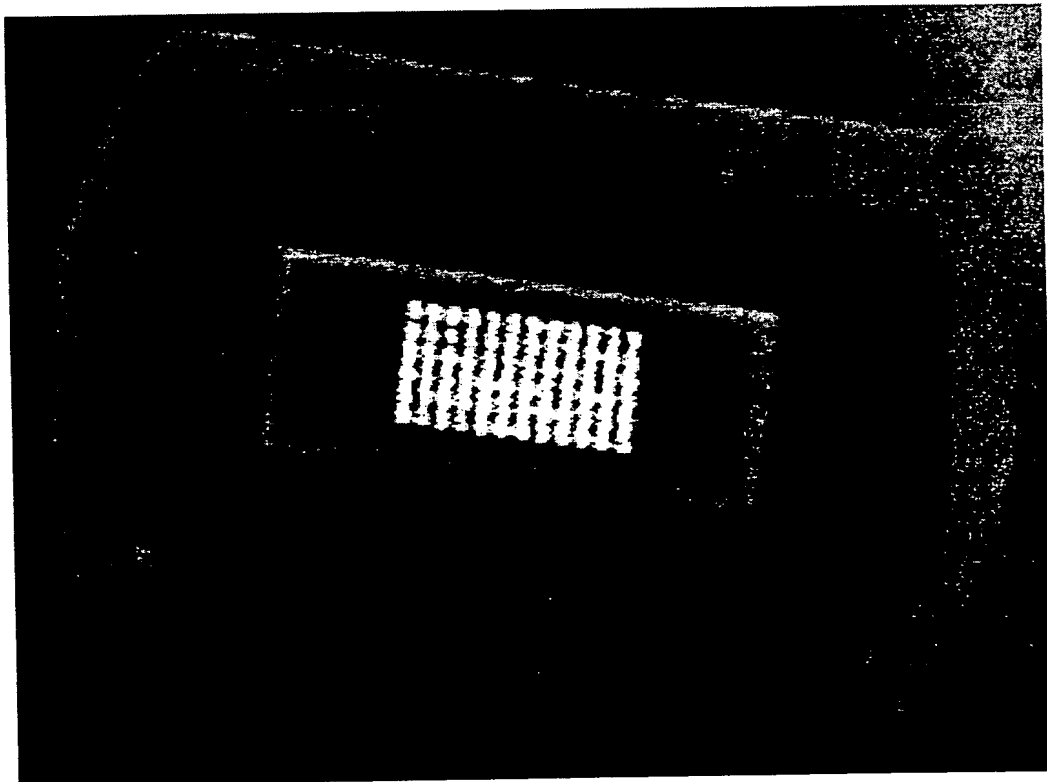


FIG. 30

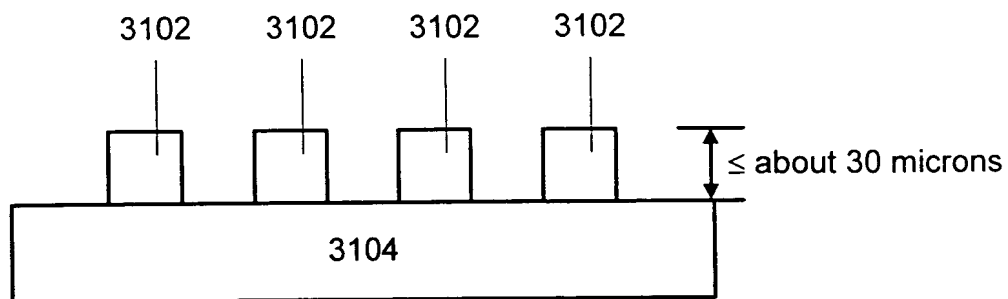


FIG. 31

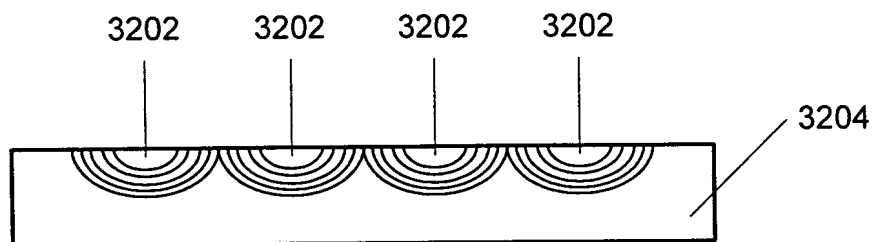


FIG. 32

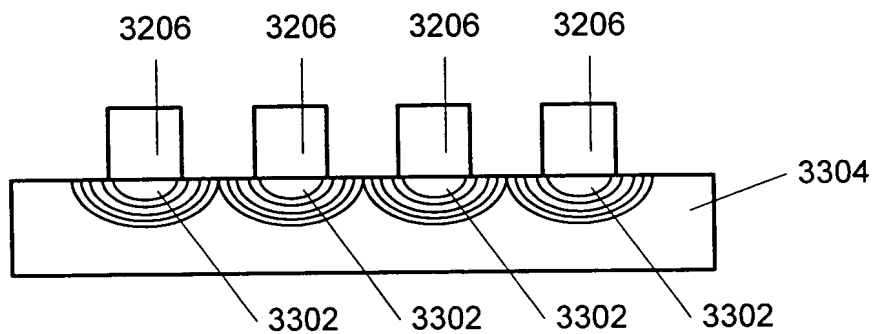


FIG. 33

FIG. 34A

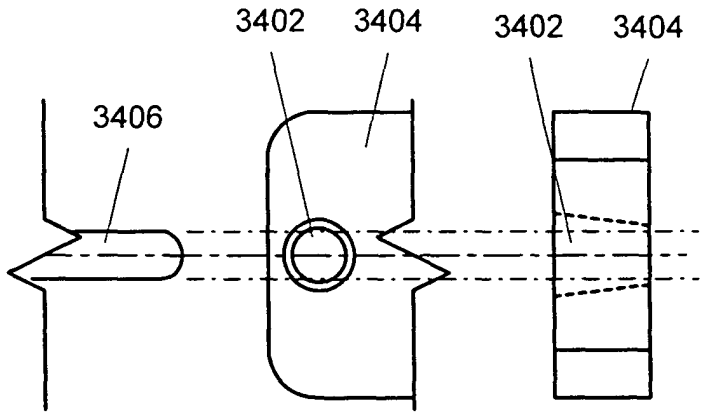


FIG. 34B

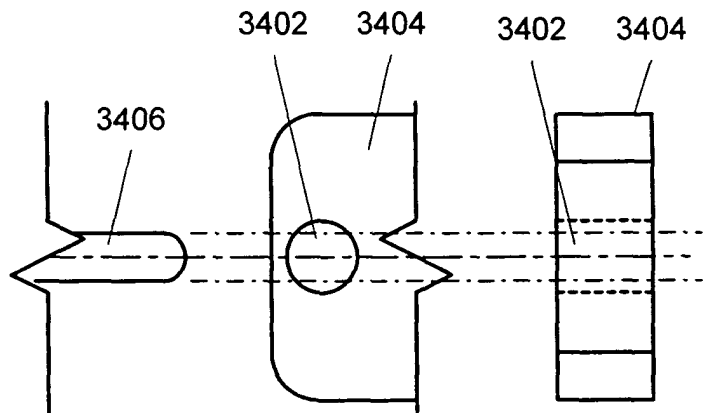
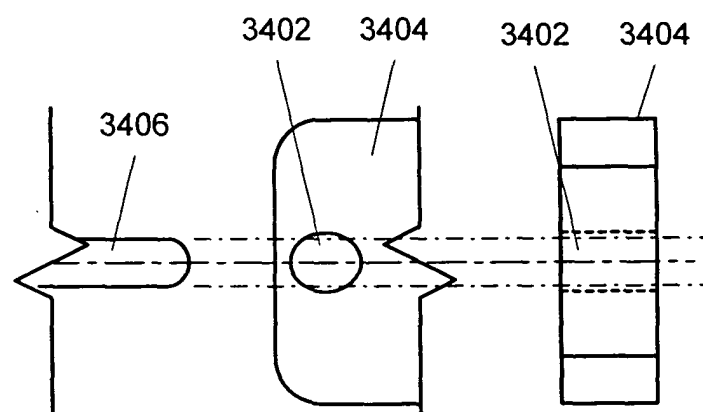


FIG. 34C



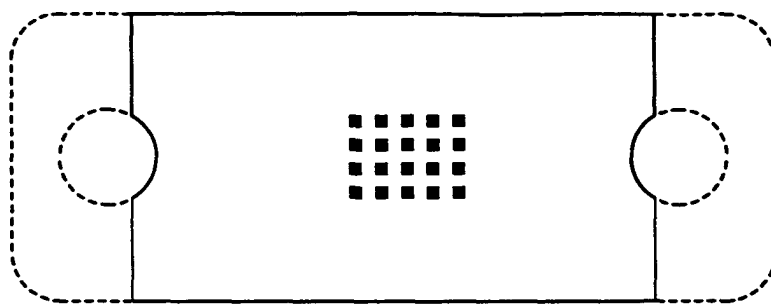


FIG. 35

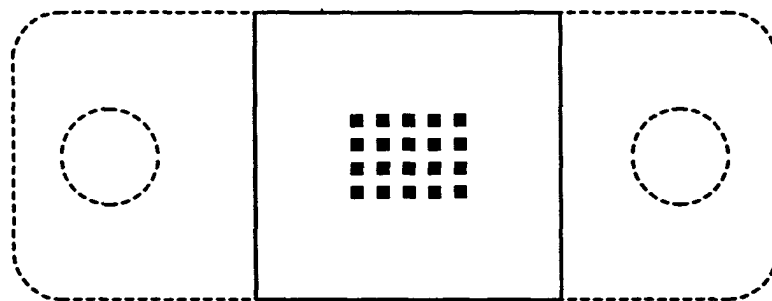


FIG. 36

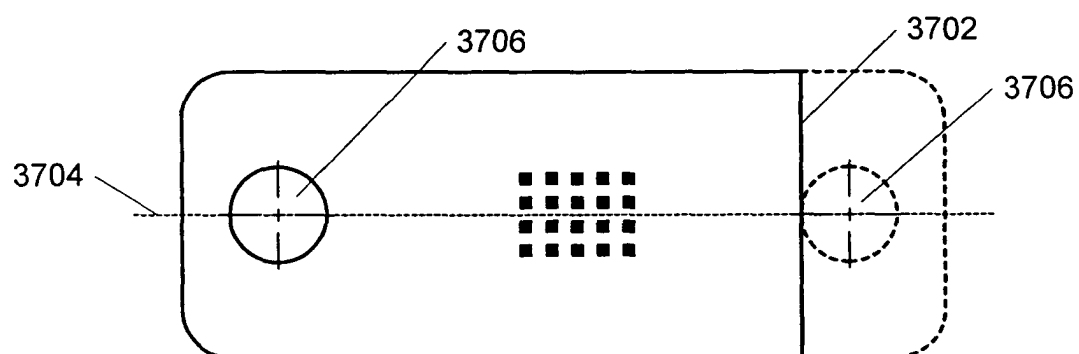
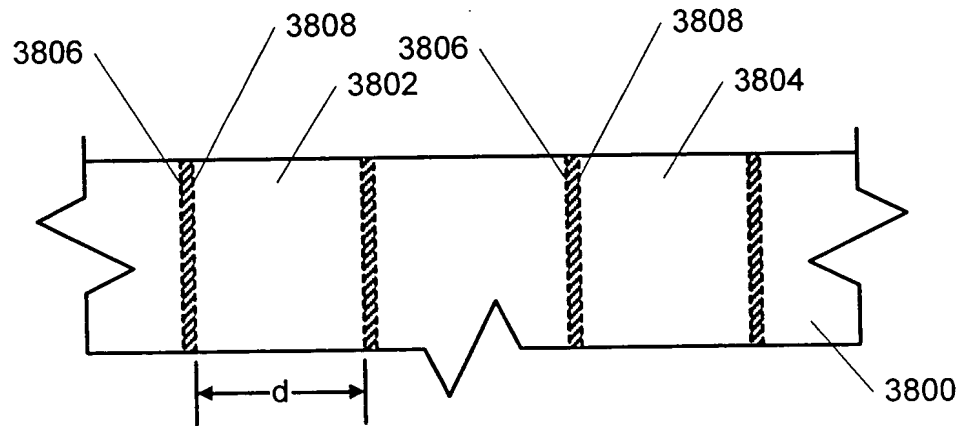
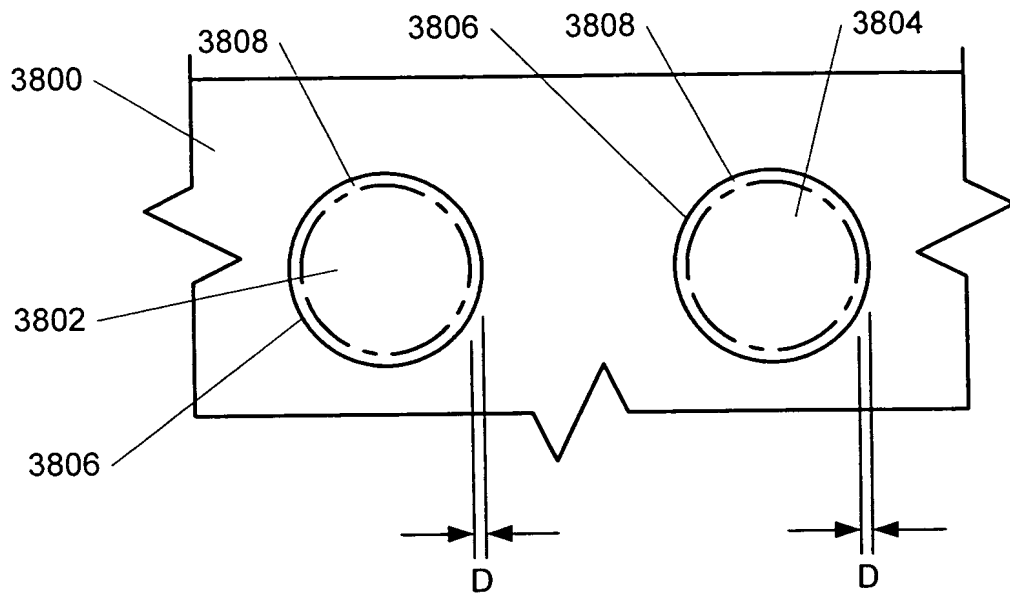


FIG. 37

Top View



Side View

FIG. 38

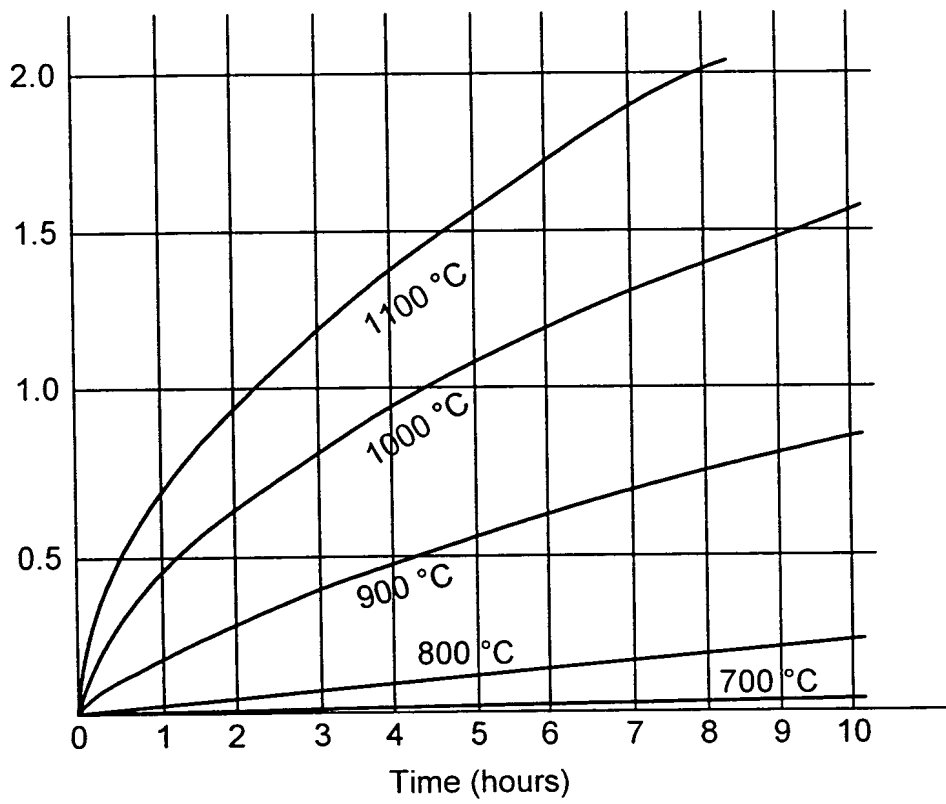
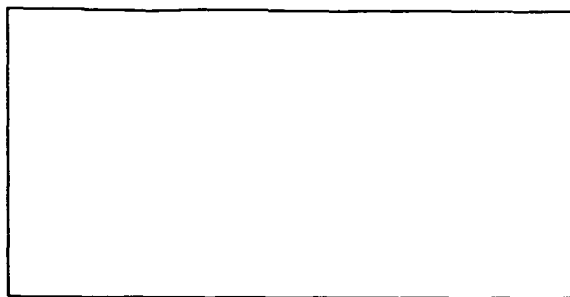
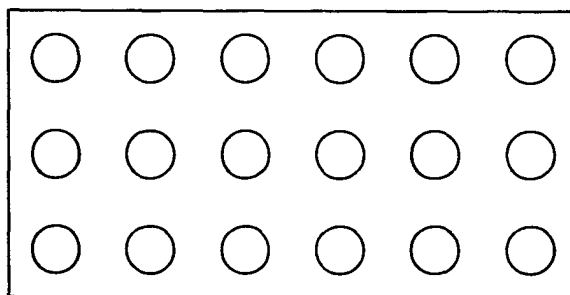


FIG. 39

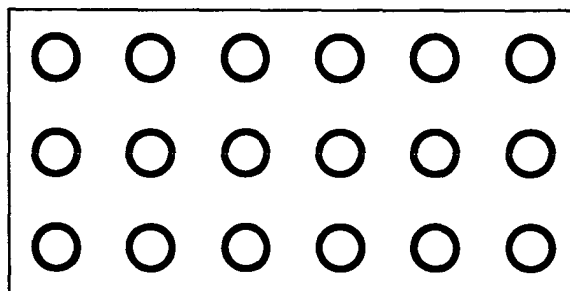
A) Base wafer



B) Holes (straight, angled, tapered, oval, etc.) made by etching, drilling, micromilling, etc.



C) Treat with reactive gas to change into lower RI material as cladding (e.g. for Si, treat with steam at high temperature to oxidize Si to form SiO_2)



D) Fill holes with material with higher RI than cladding (e.g. polyimide)

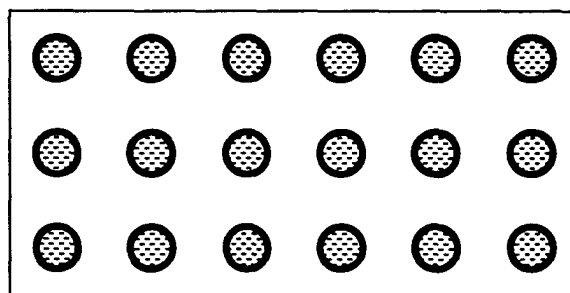


FIG. 40

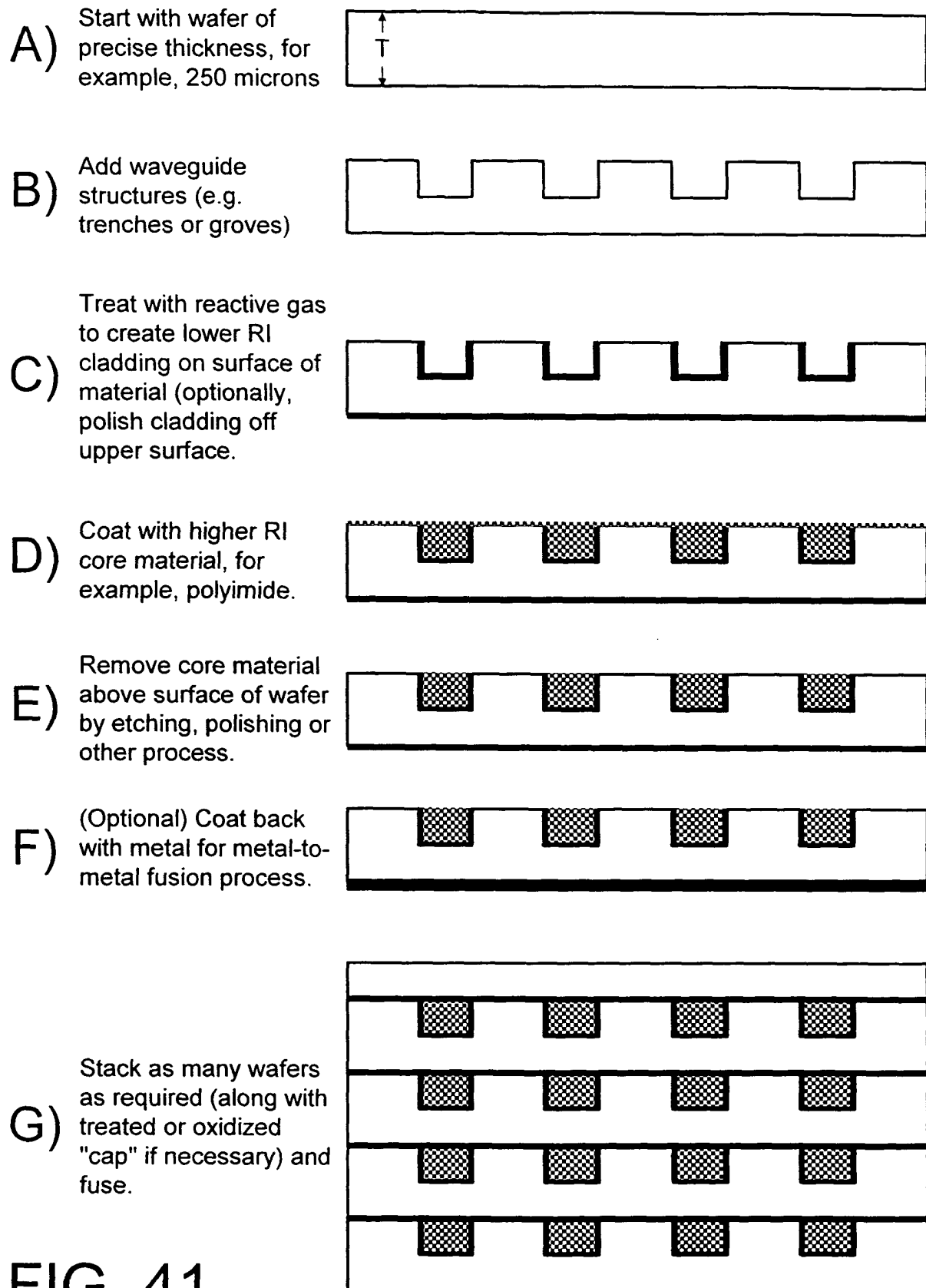


FIG. 41

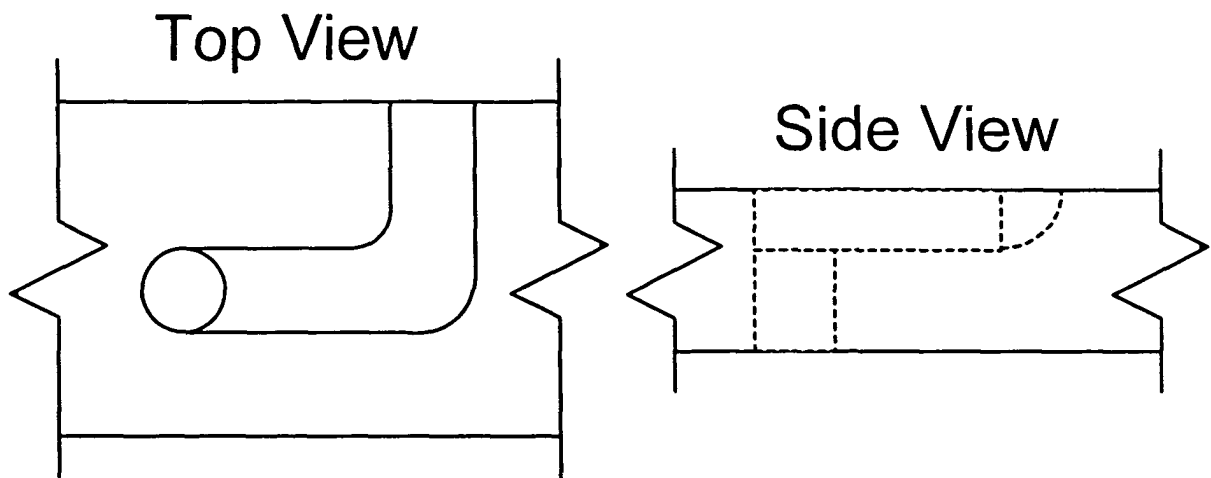


FIG. 42

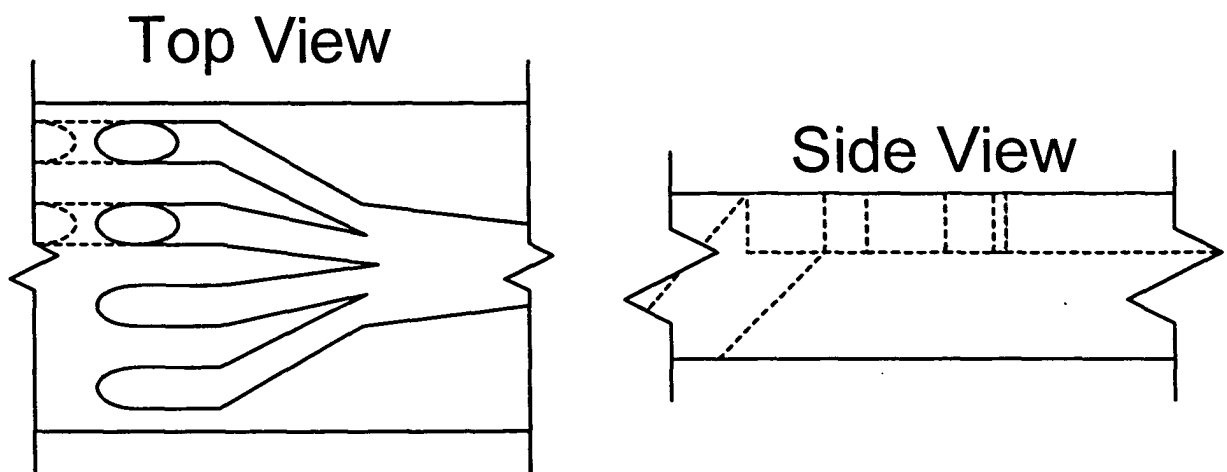


FIG. 43

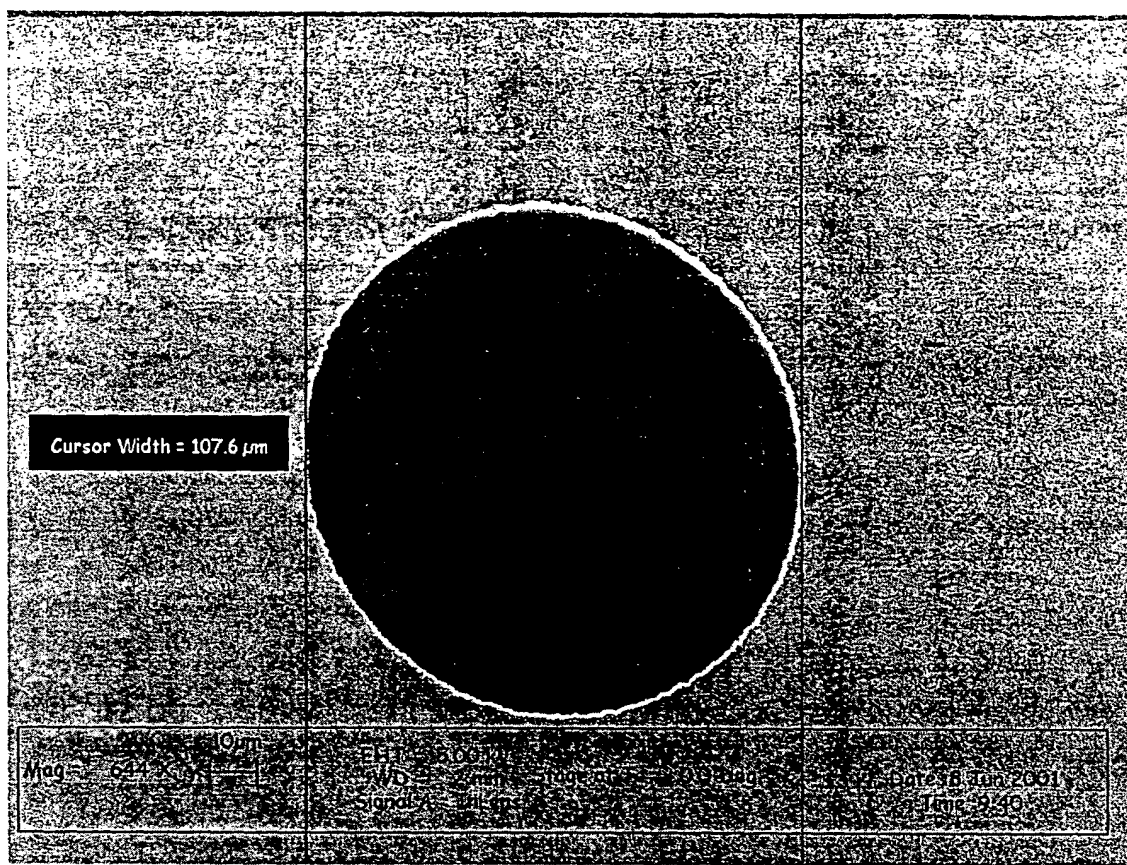


FIG. 44